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## RESTRAINING APPARATUS

1

2

3 This invention relates to restraining apparatus, and  
4 especially but not exclusively, to apparatus for  
5 securing children.

6

7 It is often difficult to control a group of children  
8 and to keep them safe in the group, particularly  
9 when taking them for walks or excursions.

10

11 According to the present invention there is provided  
12 restraining apparatus for coupling two or more users  
13 comprising at least one spine member with at least  
14 two lateral attachment members for coupling the  
15 users to the spine member, the spine member having  
16 two planes, and having more flexibility in one plane  
17 than in the other.

18

19 The spine member can be an elongate rod or plate  
20 from which the lateral attachment members extend  
21 sideways. The rod or plate is typically  
22 inextensible along its long axis and is preferably

1 rigid in its vertical plane but preferably has some  
2 lateral resilience, so that it can bend sideways in  
3 its horizontal plane with the movement of the users.  
4 Lateral resilience in the horizontal plane in use of  
5 the device is preferable to lateral resilience in  
6 the vertical planes because rigidity in the vertical  
7 plane with respect to the user has the benefit that  
8 parts of the spine member have a reduced tendency to  
9 sag and become trampled underfoot. Therefore,  
10 preferred embodiments of the device can bend  
11 laterally from side to side in the horizontal plane  
12 of the device, but not up and down in the vertical  
13 plane of the device.

14

15 In some embodiments the spine member is axially  
16 compressible and/or extensible. Plastics material  
17 is suitable for the spine members. Optionally, at  
18 least a part of the spine member is made of  
19 corrugated plastic. Alternatively, the spine member  
20 is made of composite plastics material or rubber.  
21 The spine may have a stiffening metal member such as  
22 a plastics, metal or composite plate covered with  
23 the plastics or rubber material.

24

25 The spine being flexible and/or compressible allows  
26 the users to approach each other and to turn  
27 corners.

28

29 Preferably, the attachment members are securely  
30 attached, but in a releasable manner and are  
31 typically coupled to the spine member at nodes on

1 the spine member. Preferably, each node has two  
2 attachment members.

3

4 The attachment members are typically arms. The arms  
5 may be laterally flexible and/or axially extensible  
6 and/or compressible, to absorb sudden forces. In  
7 some embodiments they can be rigid or semi-rigid, or  
8 preferably non-flexible in some planes but flexible  
9 in others.

10

11 Typically, the attachment members are pivotable with  
12 respect to the spine member. Optionally, each  
13 attachment member at each node is pivotable with  
14 respect to the other attachment member. In  
15 preferred embodiments, each node has a pair of  
16 attachment members extending laterally from opposite  
17 sides of the spine member. It is not necessary to  
18 have an attachment member extending from each side  
19 of each node; a single node can instead bear a  
20 single attachment member. Attachment members can  
21 all extend from the same side of the spine member,  
22 or from different sides. In one optional  
23 embodiment, members are staggered along the spine  
24 member.

25

26 Pivotal attachment members allow users of different  
27 heights to share one node.

28

29 Optionally, two or more spine members are connected  
30 together.

31

1 This allows a long chain of spine members and nodes  
2 to be built up, which is useful to connect a large  
3 number of users.

4  
5 Preferably, the apparatus also includes harnesses to  
6 be worn by each user. Typically, each harness is  
7 adapted to releasably engage an attachment member,  
8 to attach the user to the spine member. Typically,  
9 the harness includes a belt. Optionally, the  
10 harness includes a shoulder strap, but simple waist  
11 belts would suffice. Preferably, each harness has  
12 at least one socket to engage a protrusion on an  
13 attachment member, but other attachment formations  
14 can be used instead. Optionally, the socket  
15 includes a first plate, biased apart from and  
16 pivotable relative to a second plate, and pivoting  
17 moves the ends of the plates at the socket mouth  
18 apart to enlarge the mouth to engage/release an  
19 attachment member. Typically, the plates are biased  
20 apart by a coil spring. Typically, both plates are  
21 pivotable with respect to the socket. Another  
22 alternative attachment system could involve moulded  
23 plastic ball-joints and sockets, clips, buckles, or  
24 other similar connectors that are commercially  
25 available.

26  
27 In another aspect the invention provides a method of  
28 securing or restraining a person, comprising  
29 harnessing the person to a spine member via an  
30 attachment member, the spine member having at least  
31 two planes, and having a different degree of  
32 flexibility in respective planes.

1 Typically more than one person is harnessed to the  
2 spine member.

3

4 In some embodiments the spine and/or the harness can  
5 be coloured brightly, and/or can incorporate  
6 luminous, reflective and/or light emitting devices  
7 such as LEDs and strobes to attract attention.

8

9 An embodiment of the present invention will now be  
10 described by way of example only and with reference  
11 to the following drawings, in which:-

12

13 Fig 1 is a plan view of six children using a  
14 restraining apparatus;

15 Fig 2 is a plan view with the children with the  
16 apparatus in a compressed position;

17 Fig 3 is a plan view of the children in a  
18 curved configuration;

19 Fig 4 is a front view of a harness worn by each  
20 child;

21 Fig 5 is a front view of the apparatus worn by  
22 two children of different heights;

23 Fig 6 is a perspective view of one embodiment  
24 of the apparatus;

25 Fig 7 is a perspective view of an alternative  
26 embodiment of the apparatus;

27 Fig 8 is a perspective view of an alternative  
28 embodiment of the apparatus;

29 Fig 9 is a perspective view with interior  
30 detail of part of the apparatus, showing an arm  
31 located in a socket;

1        Fig 10 is a side view with interior detail of  
2        the arm and socket of Fig 9;

3        Fig 11 is an exploded view of a node, spine  
4        members and attachment means;

5        Fig 12 is a perspective view of the apparatus  
6        of Fig 11 with the node secured to the spine  
7        members;

8        Fig 13 is an exploded view of a node of the  
9        apparatus, spine members and an alternative  
10       attachment means;

11       Fig 14 is a perspective view of the apparatus  
12       of Fig 13 with the node secured to the spine  
13       members; and

14       Fig 15 is a schematic view of different  
15       embodiments of the apparatus.

16

17       Fig 1 shows six children 12 secured together by  
18       restraining apparatus 10. The apparatus 10 has two  
19       elongate spine members 14, 16. Each node 18, 20, 22  
20       has two lateral arms 24, 26; 28, 30; and 32, 34.

21

22       The spine members 14, 16 are optionally axially  
23       compressible and/or extensible and/or laterally  
24       flexible in the horizontal plane of the apparatus in  
25       use, to allow the apparatus to bend. This allows  
26       the children 12 to approach each other (fig 2) and  
27       turn corners (fig 3). However, the spine members  
28       14, 16 are normally inextensible, or at least only  
29       very slightly axially resilient, so that the  
30       distance between the children cannot increase to any  
31       great extent. Also, the spine members are typically  
32       comparatively more rigid in the vertical plane than

1 in the horizontal plane, so that the spine does not  
2 sag between nodes.

3

4 Different sizes of apparatus 10 are envisaged,  
5 depending on the number of children to be secured.  
6 To make a larger version of apparatus 10, additional  
7 spine members and nodes can simply be attached to  
8 the apparatus 10.

9

10 Fig 4 shows a harness 36 that is used to attach the  
11 children 12 to the apparatus 10. The harness 36 has  
12 a shoulder strap 38 and a belt 40. The belt 40 is  
13 fastened by a simple buckle 42. The belt 40 also  
14 has two sockets 44 for engagement with an arm of the  
15 apparatus 10. Sockets 44 can optionally slide on  
16 rails 46 provided in the belt, so that the child can  
17 turn sideways with respect to the spine 14, 16. The  
18 sockets 44 can typically be switched between a first  
19 configuration where they are fixed immovably to the  
20 rails 46, and a second configuration in which they  
21 can slide relative to the rails 46.

22

23 Fig 5 shows two different-sized children 12 secured  
24 to node 22 by arms 32, 34. Each user 12 is wearing  
25 a harness 36, and a socket 44 in each harness 36 is  
26 engaged with an arm 32, 34 of the node 22. The arms  
27 32, 34 are pivotable with respect to the node 22, to  
28 allow the different-sized children 12 to be  
29 connected to the apparatus 10 without twisting the  
30 apparatus 10.

31

1 The arms 32, 34 can also be axially and laterally  
2 resilient so as to resist the transfer of forces  
3 between the children connected to the node 22.

4  
5 Fig 6 shows an embodiment of apparatus 10, having  
6 spine members 60 connected to each other by single  
7 pivot nodes 54. The spine members typically  
8 comprise an elongate strip covered with a non-pvc  
9 rubber. The spine members 60 can typically comprise  
10 thin sheets of plastic, metal or composite material  
11 (such as GRP or carbon fibre), orientated so that in  
12 use the sheets lie in the vertical plane. This  
13 allows lateral but not vertical flexibility of the  
14 spine members.

15  
16 In this embodiment, each node 54 comprises a ring 56  
17 and a rod 58, which passes through the centre of the  
18 ring 56 in a direction parallel to the axis of the  
19 spine members 60. Each pair of arms 62, 64 is  
20 typically formed as a single piece, having a central  
21 bore arranged parallel to the axis of the spine  
22 members 60 and shaped to accommodate the rod 58,  
23 which passes through the bore. Each pair of arms  
24 62, 64 is pivotal around the rod 58 and is thus  
25 pivotable with respect to the spine members 60, but  
26 the arms 62, 64 are not pivotable with respect to  
27 each other. The ends of arms 62, 64 have elongate  
28 tabs 65 to engage in the sockets of the harness.  
29 Spine members 60 optionally have reflectors 68,  
30 which help the children 12 to be seen in the dark.  
31



1 Fig 7 shows an embodiment very similar to that of  
2 Fig 6, except that the rings 56 of each node 54 are  
3 closed or covered, typically by a rubber or plastics  
4 gaiter. This could help prevent fingers from  
5 becoming trapped in the nodes 54. In this  
6 embodiment the arms 62, 64 could be pivotable  
7 independently of one another.

8  
9 Fig 8 shows an alternative embodiment of apparatus  
10 110, having a number of spine members 160, each of  
11 which includes a portion of corrugated plastic  
12 tubing. The corrugated tubing allows the spine  
13 members 160 to bend laterally and to be compressed  
14 and stretched axially. The other major difference  
15 from the previous embodiment is that the arms 162,  
16 164 are pivotable relative to each other, as well as  
17 relative to nodes 154. The arms 162, 164 are also  
18 typically resilient and can be formed from a rubber  
19 material. These arms could of course be used with  
20 the earlier embodiments.

21  
22 Figs 9 and 10 show views of arm 62 engaged in socket  
23 44. Inside socket 44 is a grip device 90, which  
24 includes two plates 92, 94, each having an aperture  
25 to receive opposite ends of elongate tab 65 on the  
26 end of the arm 62. The plates 92, 94 are pivotable  
27 about respective pivot points 96, 98 and a coil  
28 spring 93 held in compression between the plates on  
29 one side of the pivot points 96, 98 at the end  
30 furthest from the socket mouth urges the other ends  
31 of the plates together to capture the tab 65 in the

1     apertures. Dual buttons 95, 97 are connected to the  
2     plate ends above and below the spring 93.

3

4     The dual buttons enable release from the apparatus.

5

6     Simpler connectors are possible, along the lines of  
7     buckles or clips conventionally used with backpacks  
8     and webbing straps, and any connector to secure the  
9     child to the arm can be used.

10

11     Figs 11 to 14 show details of possible connections  
12     between nodes 54 and spine members 60. Fig 11 is an  
13     exploded view showing spine members 60, the ends of  
14     which terminate in rods that can slide into vertical  
15     slots 72 in nodes 54 and are secured therein by  
16     bolts 74 or pins. Bolts 74 fit through a first  
17     aperture 76 in one side of ring 56, a corresponding  
18     aperture 70 in the end of each spine member 60 and  
19     through a second aperture 76 in ring 56. Fig 12 is  
20     a non-exploded view of Fig 11.

21

22     Fig 13 shows an alternative connection between nodes  
23     54 and spine members 60. Ring 54 has two end lobes  
24     80, which each have a cylindrical lateral protrusion  
25     82 in one side. The protrusions 82 are shaped to  
26     engage sockets 84 in the ends of spine members 60.  
27     Securing caps 86 attach to the protrusions 82 once  
28     they are engaged in sockets 84. The caps 86 are  
29     typically screwed to the protrusions by engaging  
30     interior screw threads of the cap 86 with exterior  
31     screw threads on the protrusion 82, but other

1 engagement means could also be used. Fig 14 is a  
2 non-exploded view of Fig 13.

3  
4 To secure a child to the restraining apparatus 10,  
5 the child 12 puts on a harness 36 and fastens the  
6 belt buckle 42. One of the sockets 44 of the  
7 harness 36 is then connected to an arm 24 of the  
8 apparatus 10. This is done by simultaneously  
9 pushing socket buttons 95, 97. This compresses the  
10 spring 93 and pivots the plates 92, 94 so the ends  
11 of the plates 92, 94 at the socket opening move away  
12 from each other. This widens the socket entrance  
13 enough to allow the elongate tab 65 to be inserted.  
14 Once the tab 65 is aligned with the apertures in the  
15 plates 92, 94, the buttons 95, 97 are released,  
16 which moves the plate ends over the tab 65, leaving  
17 the ends of the tab 65 projecting through the  
18 apertures in the plates 92, 94. Thus, the elongate  
19 tab 65 is trapped in the socket 44 and the child 12  
20 is secured to apparatus 10. The procedure is  
21 repeated to secure all the children required to  
22 respective arms of the apparatus 10.

23  
24 To disengage a child 12 from the apparatus 10, the  
25 socket buttons 95, 97, are simultaneously compressed  
26 and held down. This compresses spring 93, and  
27 pivots the plates 92, 94 to widen the socket opening  
28 as before. This releases the tab 65 from the  
29 apertures in the plates 92, 94 and the arm 62 is  
30 then pulled out of the socket 44. The buttons 95,  
31 97 are now released and the child takes off the

1     harness 36. This procedure is repeated to release  
2     all children 12 from the apparatus 10.

3

4     Modifications and improvements can be incorporated  
5     without departing from the scope of the invention.  
6     For example, the position of the tabs and sockets  
7     could be reversed, i.e. each arm could have a socket  
8     and the harness could have a tab to engage the  
9     socket.

10

11    The arm and socket do not have to engage by  
12    apertures in plates engaging the arms; any way of  
13    attaching the arm to the socket would be adequate,  
14    e.g. the arm could screw into the socket.

15

16    The socket could be replaced by a lock mechanism,  
17    requiring a special tool to release the arm, so that  
18    a child secured to the apparatus could not release  
19    itself.

20

21    Two sets of apparatus could be used parallel to each  
22    other, with a central column of children attached to  
23    both apparatus. Figure 15 shows a number of  
24    different schematic combinations of children 12,  
25    spines 100 and arms 110. Not all of the nodes need  
26    to be provided with arms at each side, nor do all  
27    the nodes or arms need to be occupied by children.

28

29    Embodiments of the invention could be created using  
30    a single spine instead of separate spine members  
31    (thereby removing the need for nodes) where the arms  
32    extend out through apertures in the spine. The

- 1 harnesses could be permanently attached to the
- 2 apparatus (instead of releasably attached by the arm
- 3 and socket connection).
- 4